

Claims

What is claimed is:

- 5 1. A heating and cooling system for a vehicle having an engine and a passenger compartment, the heating and cooling system comprising:
 at least one coolant loop having a coolant outlet line and a coolant inlet line adapted to operatively engage the engine, a heater core, a first coolant/refrigerant heat exchanger, a second coolant/refrigerant heat exchanger, and at least one coolant valve
10 for selectively directing flow of a coolant from the coolant outlet line to the coolant inlet line through at least one of the heater core, the first coolant/refrigerant heat exchanger, and the second coolant/refrigerant heat exchanger;
 a pump operatively engaging the at least one coolant loop; and
 a refrigerant loop having a compressor with an inlet and an outlet, a first
15 refrigerant valve for selectively directing the flow of a refrigerant from the compressor outlet to one of a condenser and the second coolant/refrigerant heat exchanger, a first refrigerant passage connected to the condenser for directing the flow of the refrigerant from the condenser, through a first expansion device and to an evaporator, and a second refrigerant line connected to the second coolant/refrigerant
20 heat exchanger for directing the flow of the refrigerant from the second coolant/refrigerant heat exchanger, through a second expansion device and to the first coolant/refrigerant heat exchanger.
- 25 2. The heating and cooling system of claim 1 wherein the refrigerant loop includes a one-way valve located in the refrigerant loop to allow refrigerant to flow through the evaporator in only one direction.
3. The heating and cooling system of claim 1 wherein the refrigerant loop includes an accumulator operatively engaging the compressor inlet.
- 30 4. The heating and cooling system of claim 1 wherein the first refrigerant valve is a three-way valve.

5. The heating and cooling system of claim 1 wherein the first expansion device is an orifice tube.

5 6. The heating and cooling system of claim 1 wherein the at least one coolant valve is a four-way valve.

7. The heating and cooling system of claim 1 wherein the at least one coolant valve comprises a first four-way coolant valve and a second four-way coolant valve.

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8. The heating and cooling system of claim 1 wherein the heater core and the evaporator are adapted to be located in the passenger compartment.

9. The heating and cooling system of claim 1 wherein the second expansion
15 device is an orifice tube.

10. The heating and cooling system of claim 1 wherein the at least one coolant valve comprises a first three-way coolant valve and a second three-way coolant valve.

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11. The heating and cooling system of claim 1 wherein the at least one coolant loop further includes a modulating coolant valve operatively engaging the coolant outlet line for selectively restricting the amount of coolant flow in the at least one coolant loop.

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12. The heating and cooling system of claim 1 wherein the pump is electronically controllable.

13. The heating and cooling system of claim 1 wherein the first expansion
30 device is a first orifice tube, and the second expansion device is a second orifice tube; and the refrigerant loop further includes an accumulator operatively engaging the compressor inlet.

14. A heating and cooling system for a vehicle having an engine and a passenger compartment, the heating and cooling system comprising:

- 5 a first coolant loop having a coolant outlet line and a coolant inlet line adapted to couple to the engine, a heater core, a first coolant/refrigerant heat exchanger, and a first coolant valve and a second coolant valve for selectively directing flow of a coolant from the coolant outlet line to the coolant inlet line through one of the heater core and the first coolant/refrigerant heat exchanger;
- 10 a second coolant loop having a second coolant/refrigerant heat exchanger with a coolant inlet line and a coolant outlet line which are selectively connected for coolant flow through the heater core by the first coolant valve and the second coolant valve;
- a pump operatively engaging at least one of the first coolant loop and the second coolant loop; and
- 15 a refrigerant loop having a compressor with an inlet and an outlet, a first refrigerant valve for selectively directing the flow of a refrigerant from the compressor outlet to one of a condenser and the second coolant/refrigerant heat exchanger, a first refrigerant passage connected to the condenser for directing the flow of the refrigerant from the condenser, through a first expansion device and to an evaporator, and a second refrigerant line connected to the second coolant/refrigerant heat exchanger for directing the flow of the refrigerant from the second
- 20 coolant/refrigerant heat exchanger, through a second expansion device and to the first coolant/refrigerant heat exchanger.

25 15. The heating and cooling system of claim 14 wherein the first expansion device is a first orifice tube, and the second expansion device is a second orifice tube; and the refrigerant loop further includes an accumulator operatively engaging the compressor inlet.

30 16. The heating and cooling system of claim 14 wherein the evaporator includes an outlet, and the refrigerant loop includes a one-way valve operatively engaging the evaporator outlet to allow refrigerant to flow through the evaporator in only one direction.

17. The heating and cooling system of claim 14 wherein the first coolant loop further includes a modulating coolant valve for selectively restricting the amount of coolant flow in the first coolant loop.

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18. A method of providing heating and cooling to a passenger compartment of a vehicle having an engine, the method comprising the steps of:

selectively circulating a coolant from the engine, through at least one of a heater core and a first coolant/refrigerant heat exchanger, and back to the engine;

10 selectively circulating the coolant from a pump, through one of a second coolant/refrigerant heat exchanger and the heater core, through the other of the second coolant/refrigerant heat exchanger and the heater core, and back to the pump; and

selectively circulating a refrigerant from a compressor and back to the
15 compressor through one of a first refrigerant path, having a condenser and an evaporator, and a first expansion device between the condenser and the evaporator, and a second refrigerant path, having the second coolant/refrigerant heat exchanger, the first coolant/refrigerant heat exchanger, and a second expansion device between the second coolant/refrigerant heat exchanger and the first coolant/refrigerant heat
20 exchanger.

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19. The method of claim 18 further including the step of circulating the refrigerant through an accumulator just prior to circulating the refrigerant through the compressor.

20. The method of claim 18 further including the step of preventing the circulation of refrigerant through the evaporator in more than one direction.

21. The method of claim 18 further including the step of selectively
30 modulating the circulation of coolant from the engine.

22. The method of claim 18 wherein the step of selectively circulating the coolant from the engine includes, selectively circulating the coolant through the first

coolant/refrigerant heat exchanger, the second coolant/refrigerant heat exchanger, the heater core, and back to the engine.

23. The method of claim 18 wherein the step of selectively circulating the
5 coolant from the engine includes selectively circulating the coolant from the engine through one of the heater core or the first coolant/refrigerant heat exchanger and back to the engine.

24. The method of claim 18 wherein the step of selectively circulating
10 refrigerant is further defined by, the first expansion device through which refrigerant is circulating being an orifice tube.

25. The method of claim 18 wherein the step of selectively circulating
refrigerant is further defined by, the second expansion device through which
15 refrigerant is circulating being an orifice tube.